INSTRUCTION MANUAL

MODEL 10A

IEEE-488 BUS INTERFACE UNIT

10A
280

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CHAPTER I

GENERAL INFORMATION

1.1 GENERAL

The Model 10A provides IEEE 488-1978 Bus capability for these existing Boonton programmable instruments: Models 42BD, 62AD, 72BD, 92BD, and 93AD. The capability of the 10A when connected with the instruments mentioned above is specified in Table 1.

TABLE 1

INTERFACE FUNCTIONS

SH1	Source handshake capability
AH1	Acceptor handshake capability
T7	Talker (basic talker, no serial poll talk only mode, unaddressed to talk if addressed to listen)
L3	Listener (basic listener, listen only mode, unaddress to listen when addressed to talk)
SR0	No service request capability
RL1	Remote/Local capability
PP0	No parallel poll capability
DC1	Device clear capability
DT1	Device trigger capability
C0	No controller capability

1.2 ADDRESS SELECTION

The talk and listen addresses of the 10A are selected by the address selector switch located on the rear panel. This switch is a seven position "DIP" switch with positions marked "1" through "5" as the address code and positions 6 and 7

CHAPTER 1

GENERAL INFORMATION

1.1 GENERAL

The Model 10A provides IEEE 488-1978 bus capability for three existing Bodine programmable instruments: Models 4280, 4240, 7280, 9280, and 9340. The capability of the 10A when connected with the instruments mentioned above is specified in Table 1.

TABLE 1

INTERFACE FUNCTIONS

SH1	Source handshake capability
AH1	Acceptor handshake capability
T7	Talker (basic talker, no serial poll talk only mode, unaddressed to talk if addressed to listen)
L3	Listener (basic listener, listen only mode, unaddress to LISTEN when addressed to talk)
SR0	No service request capability
RL1	Remote/Local capability
PP0	No parallel poll capability
DC1	Device clear capability
DT1	Device trigger capability
C0	No controller capability

1.2 ADDRESS SELECTION

The talk and listen addresses of the 10A are selected by the address selector switch located on the rear panel. This switch is a seven position "DIP" switch with positions marked "1" through "5" as the address code and positions 6 and 7

for talk or listen only selection. Listed below are the available address codes and the corresponding switch settings.

ADDRESS SELECTION

ASCII Code Character		Address Switches					
Listen	Talk	A5	A4	A3	A2	A1	5-bit Decimal Code
SP	@	0	0	0	0	0	00
!	A	0	0	0	0	1	01
"	B	0	0	0	1	0	02
#	C	0	0	0	1	1	03
$	D	0	0	1	0	0	04
%	E	0	0	1	0	1	05
&	F	0	0	1	1	0	06
'	G	0	0	1	1	1	07
(	H	0	1	0	0	0	08
)	I	0	1	0	0	1	09
*	J	0	1	0	1	0	10
+	K	0	1	0	1	1	11
,	L	0	1	1	0	0	12
-	M	0	1	1	0	1	13
.	N	0	1	1	1	0	14
/	O	0	1	1	1	1	15
Ø	P	1	0	0	0	0	16
1	Q	1	0	0	0	1	17
2	R	1	0	0	1	0	18
3	S	1	0	0	1	1	19
4	T	1	0	1	0	0	20
5	U	1	0	1	0	1	21
6	V	1	0	1	1	0	22
7	W	1	0	1	1	1	23
8	X	1	1	0	0	0	24
9	Y	1	1	0	0	1	25
:	Z	1	1	0	1	0	26

ASCII Code Character		Address Switches					
Listen	Talk	A5	A4	A3	A2	A1	5-bit Decimal Code
;	[	1	1	0	1	1	27
<	\	1	1	1	0	0	28
=	]	1	1	1	0	1	29
>	∿	1	1	1	1	0	30

1.3 TALK ONLY

The 10A is placed in the talk only mode by setting the TALK ONLY switch, located on the rear panel, to the "1" position. In this mode the 10A will continuously output data.

1.4 LISTEN ONLY

The 10A is placed in the listen only mode by setting the LISTEN ONLY switch, located on the rear panel, to the "1" position. In this mode the 10A can be used under remote control.

1.5 TALK AND LISTEN

The 10A is placed in the "talk and listen" mode by setting both the TALK ONLY and LISTEN ONLY switches to the "0" position. In this mode the 10A can either output data or receive command and/or data from a remote controller.

CHAPTER II

PROGRAMMING

2.1 OPTION -01

Model 10A-01 is designed to be compatible with the Model 42BD Microwattmeter. It provides the user with the capability to select either Power Mode (by sending command "P") or dB Mode (by sending command "D"), to hold meter encoding (by sending command "H") or trigger it (by sending command "T"), to select a specified range (by sending command "R1~R7") or Auto Range (by sending command "A"). Normally, the Encode Hold message will be reset automatically after meter data has been sent out. If such a version is not desirable, the user should send command "B" so that Encode Hold is permanently true. To release, command "F" should be used. Refer to Table 2 for a summary. The user can also select one of the three Universal Commands: "Group Execute Trigger", "Device Clear", and "Go to Local".

2.1.1 Group Execute Trigger - The 10A must be addressed to "listen" in order to respond to the trigger message. The message causes the 10A to acquire and store panel meter data.

2.1.2 Device Clear - The 10A will respond to Device Clear by going to local and assuming an idle state.

2.1.3 Go To Local - When the Go To Local message is received, the 10A will return to local front panel control.

2.1.4 If addressed to "talk" the data is sent out in the following format:

Range Code, Front Panel Display (floating point number), Range Condition (1 = underrange, 2 = overrange, 3 = range O.K.), CR/LF

TABLE 2

The 42BD responds to the following commands:

P	Power Mode
T	Trigger
H	Encode Hold
D	dB Mode
A	Auto Range
R	Range Selection (1 ∿ 7)
B	Hold Encode Permanently
F	Override "B"

Data Output Format is as follows:

Range code, front panel display, range condition CR/LF

1 ∿ 7 power mode: 0 - OK

d,dddd.E-d,d 1 - Overrange

2 - Underrange

The data is always in the above format. No change can be made in the order or quantity.

Data string length in the Power Mode is 12 characters, including punctuation.

Data string length in the dB Mode is 14 characters, including punctuation.

Following are two examples using the HP9815 and 9825A calculators as controller.

Example 1: The user intends to select Power Mode, 100 μW Range, hold the encode until the time to trigger it, and then obtain the meter data.

Assume the rear panel address switch is set like this: Talk Only = 0, Listen Only = 0, Address = 10010 = 18 (Decimal).

The program may be like this:

```
                    1
                    ENTER ↑
                    18
                    ENTER ↑
                    CALL α
                    5
                    CALL α
                    RUN
          (Now the 10A is addressed to "listen".)
                    R
                    5
       (100 μW range is selected.)
                    H
            (ENCODE HOLD)
                    T
             (TRIGGER)
```

Responding to the trigger message, the 10A acquires and stores panel meter data.

To obtain the data, the user may program as follows:

```
                    CALL α          (go out of command mode)
                    CLEAR           (clear memory)
10A
280
```

CANC n	(go out of command mode)
clear	(clear memory)

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
H
```

Now the controller acquires the data. The data string may be like this:

```
5                    (100 µW range)
23.4      -06        (E-06 = µW)
3                    (Range selected OK)
```

Example 1A: Using the HP 9825A with GEN I/O and extended I/O (ROM 98216A or 98213A).

```
10A Remote Enable                          rem718

10A programmed to 100 µW range,            wrt718,"R5HT"
enclode hold and trigger

Data read into Registers A, B, and         red718,A,B,C
C

Two display formats are shown. The         dspA,B,C
10A outputs a comma after each data         5.000e 00  1.06
group.                                     9e-04  3.000e 00

                                           dspA
                                            5.000e 00

                                           dspB
                                            1.069e-04

                                           dspC
                                            3.000e 00
```

Example 1B: Using the HP 9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
100 µW Range, Encode Hold, Trigger	wrt718,"R5HT"
String designated as A$ is dimensioned at 12 characters	dimA$[12]
10A data output read into A$	red718,A$
Displayed results of A$ content	dspA$ 5,106.2E-6,3

Example 2: The user intends to select dB mode, Auto Range, hold encode permanently, trigger it, read the data, trigger it again later on, read the data, and then release Encode Hold. The user may program like this:

```
                    1
                    ENTER ↑
                    18
                    ENTER ↑
                    CALL α
                    5
                    CALL α
                    RUN
(Now the 10A is addressed to "listen".)
                    D
          (10A in dB mode)
                    A
          (10A in Auto Range)
                    B
(Encoding is held permanently.)
                    T
               (Trigger)
```

10A

8

```
(Trimmer)
T
(Removing in-hole remainder.)
```

By using the program in Example 1, the controller may acquire the following data string:

```
2                    (100 nW range)
-43.21     00        (dB = -43.21)
3                    (Range condition is OK)
```

Now if the user wants to trigger it again, the following program may be used:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
(10A addressed to "listen" again.)
T
(Trigger)
F
(Permanent Encode Hold released)
```

Program the 10A to be "talker" again to obtain the second data string.

Example 2A: With the HP 9825A configured as in Example 1A:

```
10A Remote Enable                          rem718

dB Mode, -10 dBm range, Encode Hold        wrt718,"DR5BT"
permanently, Trigger

Data output to Registers A, B, and C       red718,A,B,C
```

Displayed Results:	Range Code	dspA 5.00
	Data	dspB -9.88
	Range Condition	dspC 3.00

Example 2B: With the HP 9825A Configured as in Example 1B:

10A Remote Enable	rem718
dBm Mode, -10 dBm Range, Encode Hold permanently, Trigger	wrt718,"DR5BT"
String length allocated at 14 characters	dimA$[14]
Data read	red718,A$
Displayed Results - *Note that data output length is 14 characters in dB mode.*	dspA$ 5,-09.87E+00,3
Trigger, Override "B"	wrt718,"TF"
Data output	red718,A$
Displayed results	dspA$ 5,-09.87E+00,3

2.2 OPTION -02

Model 10A-02 is designed to be compatible with the Model 62AD Inductance Meter. It provides the user with the capability to hold meter encoding (by sending command "H") or trigger it (by sending command "T"), to select a specified range (by sending command "R1" through "R4") or Auto Range (by sending command "A").

Normally the Encode Hold message will be reset automatically after the meter data has been sent. If such a version is not desirable, the user should send command "B" so that Encode Hold is permanently true. To release, command "F" should be used. Refer to Table 3 for a summary. The user can also use one of the three Universal Commands: "Group Execute Trigger", "Device Clear", and "Go To Local".

2.2.1 Group Execute Trigger - The 10A must be addressed to "listen" in order to respond to the trigger message. The message causes the 10A to acquire and store panel meter data.

2.2.2 Device Clear - The 10A will respond to Device Clear by going to local and assuming an idle state.

2.2.3 Go To Local - When the Go To Local message is received the 10A will return to local front panel control.

2.2.4 If addressed to "talk" the data is sent out in the following format:

> Range Code, Front Panel Display (floating point number), Range Condition (1 = underrange, 2 = overrange, 3 = range O.K.), CR/LF

Following are examples using the HP 9815 Calculator as the controller.

Example 1: The user intends to select 200 µH range, hold encoding, trigger it and then acquire the panel meter reading. Assume the rear panel address switch is set like this: Talk Only = 0, Listen Only = 0, Address = 10010 = 18 (Decimal). The controller program may be like this:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
(Now the 10A is addressed to "listen".)
R
3
(Range 3 - 200 μH Range selected)
H
(ENCODE HOLD)
T
(TRIGGER)
```

Responding to the trigger message, the 10A acquires and stores panel meter data. To fetch the data, the user may program as follows:

```
CALL α      (go out of command mode)
CLEAR       (clear memory)
1
ENTER ↑
18
ENTER ↑
CALL α
5
H
```

Now the controller acquires the data. The data string may be like this:

```
3          (200 μH range)
123.4  -06 (E-06 = μH)
3          (Range selected O.K.)
```

Example 1A: Using the HP 9825 A with GEN I/O and extended I/O ROM 98126A or 98213A)

10A Remote Enable		rem718
200 µH range selected, Encode Hold, Trigger		wrt718,"R3HT"
Controller acquires data, stored in Registers A, B, and C		red718,A,B,C
Displayed Results:		
	Range Code	dspA 3.000e 00
	Data	dspB 1.018e-04
	Range Condition	dspC 3.000e 00

Example 1B: Using the HP 9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
200 µH range selected, Encode Hold, Trigger	wrt718,"R3HT"
String designated A$ allocated for 12 characters	dimA$[12]
Controller acquires data	red718,A$
Displayed results	dspA$ 3,102.0E-6,3

Example 2: The user intends to select Auto Range, hold encode permanently, trigger it, read the data, trigger it again, read the data, and then release Encode Hold.

The user may program like this:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
```

(The 10A is addressed as "listener".)

```
A
```

(10A in Auto Range)

```
B
```

(Encoding is held permanently.)

```
T
```

(Trigger)

By using the program in Example 1, the controller may acquire the following data string:

```
1          (20 μH range)
12.34  -06 (E-06 = μH)
3          (Range condition is O. K.)
```

If the user wants to trigger the instrument again and then release Encode Hold, the following program may be used.

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
```

RUN

(The 10A is addressed to "listen" again)

T

(Trigger)

F

(Permanent Encode Hold released)

If the user programs the 10A to be "talker" again, he obtains the second data string.

The 62AD responds to the commands listed in Table 3.

TABLE 3

T	Trigger
H	Hold
A	Auto Range
R	Range Selection (1 ∿ 4)
B	Hold Encode Permanently
F	Override "B"

Example 2A: Using the HP 9825A with Gen I/O and extended I/O (Rom 98126A or 98213A):

10A Remote Enable	rem718
Auto Range selected, Hold Encode, Trigger. Alpha character inserted before command string to slow 9825.	wrt718,"QABT"
Data acquired by controller, stored in Registers A, B, and C	red718,A,B,C
Displayed results	dspA 3.000e 00

	dspB 3.150e-05
	dspC 3.000e 00
Instrument retriggered, Encode Hold released	wrt718,"TF"
Read data	red718,A,B,C
Displayed results	dspA 3.000e 00
	dspB 3.150e-05
	dspC 3.000e 00

Example 2B: Using the HP9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
Auto Range selected, Hold Encode, Trigger	wrt718,"QABT"
String allocated	dimA$[12]
Data acquired by controller	red718,A$
Results displayed	dspA$ 3,031.6E-6,3
Instrument retriggered, Encode Hold released	wrt718,"TF"

Data acquired by controller red718,A$

Displayed result dspA$

3,031.5E-6,3

2.3 OPTION -03

Model 10A-03 is designed to be compatible with the 72BD Digital Capacitance Meter. It provides the user with the capability to hold meter encoding (by sending command "H") or trigger it (by sending command "T"), to select a specified range (by sending command "R1" - "R4") or Auto Range (by sending command "A").

Normally the Encode Hold message will be reset automatically after meter data has been sent. If such a version is not desirable, the user should send command "B" so that Encode Hold is permanently true. To release, command "F" should be used. Refer to Table 4 for a summary.

One of three Universal Commands may also be used. They are "Group Execute Trigger", "Device Clear", and "Go To Local".

TABLE 4

T	Trigger
H	Hold
A	Auto Range
R	Range Selection (1 - 4)
B	Hold Encode permanently
F	Override "B"

2.3.1 Group Execute Trigger - The 10A must be addressed to "listen" in order to respond to the trigger message. The message causes the 10A to acquire and store panel meter data.

2.3.2 Device Clear - The 10A will respond to Device Clear by going to local and assuming an idle state.

2.3.3 Go To Local - When the Go To Local message is received, the 10A will return to local front panel control.

2.3.4 If addressed to "talk", the data is sent out in the following format:

Range Code, Front Panel Display (floating point number), Range Condition (1 = underrange, 2 = overrange, 3 = range OK), CR/LF

Following are examples using the HP 9815 calculator as the controller.

Example 1: The user intends to select 200 pF range, hold encoding, trigger the instrument, and then obtain the panel meter reading.

Assume the rear panel address switch is set like this: Talk Only = 0, Listen Only = 0, Address = 10010 = 18 (Decimal).

The controller program may be as follows:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
(Now the 10A is addressed to "listen".)
R
3
(Range 3 = 200 pF range selected)

H
(Encode Hold)
T
(Trigger)
```

Responding to the trigger message, the 10A acquires and stores panel meter data. To fetch the data, the user may program as follows:

```
CALL α              (go out of command mode)
CLEAR               (clear memory)
1
ENTER ↑
18
ENTER ↑
CALL α
5
H
```

Now the controller acquires the data. The data string may be like this:

```
3                   (200 pF range)
123.4 -12           (E-12 = pF)
3                   (Range selected OK)
```

Example 1A: Using the HP 9825A with Gen I/O and extended I/O (ROM 98126A or 98213A) :

```
10A Remote Enable                          rem718

200 pF range selected, Encode Hold,        wrt718,"R3HT"
Trigger

Controller acquires data                   red718,A,B,C

Results displayed                          dspA
                                           3.000e 00

                                           dspB
                                           1.000e-10

                                           dspC
                                           3.000e 00
```

Example 1B: Using the HP 9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
200 pF range selected, Encode Hold, Trigger	wrt718,"R3HT"
String allocated	dimA$ 14
Controller acquires data	red718,A$
Displayed results	dspA$ 3,100.2E-12,3

Example 2: The user intends to select Auto Range, hold encode permanently, trigger it, read the data, trigger it again, read the data, and then release Encode Hold. The program may be as follows:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
```

(The 10A is addressed as "listener".)

```
A
```

(10A in Auto Range)

```
B
```

(Encoding is held permanently.)

```
T
```

(Trigger)

Using the program in Example 1, the controller may acquire the following data string:

10A
280

```
2                    (20 pF range)
12.34 -12            (E-12 = pF)
3                    (Range condition is OK)
```

Now if the user wants to trigger the instrument again and then release Encode Hold, the following program may be used.

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
(The 10A is addressed to "listen" again.)
T
(Trigger)
F
(Release Permanent Encode Hold)
```

If the user programs the 10A to be "talker" again, he obtains the second data string.

Example 2A: Using the HP 9825A with Gen I/O and extended I/O (ROM 98126A or 98213A):

```
10A Remote Enable                        rem718

Auto Range selected, Hold Encode,
Trigger, Alpha character inserted
before command string to slow HP 9825A  wrt718,"QABT"

Data acquired by controller, stored      red718,A,B,C
in Registers A, B, and C.
```

Displayed results	dspA 3.000e 00 dspB 1.081e-10 dspC 3.000e 00
Instrument retriggered	wrt718,"TF"
Read data	red718,A,B,C
Displayed results	dspA,B,C 3.000e00 1.08 1e-10 3.000e 00

Example 2B: Using the HP9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
Auto Range selected, Hold Encode, Trigger	wrt718,"QABT"
String allocated	dimA$[14]
Data acquired by controller	red718,A$
Results displayed	dspA$ 3,1.081e-10,3
Instrument retriggered, Encode Hold released	wrt718,"TF"

Data acquired by controller	red718,A$
Displayed result	3,1.081e-10,3

2.4 OPTION -04

Model 10A-04 is designed to be compatible with the 92BD RF Millivoltmeter. It provides the user with the capability to select either Voltage Mode (by sending command "V") or dB Mode (by sending command "D"), to hold meter encoding (by sending command "H") or trigger it (by sending command "T"), to select a specified range (by sending command "R1" - "R8") or Auto Range (by sending command "A").

Normally the Encode Hold message will be reset automatically after meter data has been sent. If such a version is not desirable, the user should send command "B" so that Encode Hold is permanently true. To release, command "F" should be used. Refer to Table 5 for a summary.

TABLE 5

V	mV Mode
T	Trigger
H	Encode Hold
D	dB Mode
A	Auto Range
R	Range Selection (1 - 8)
B	Hold Encode Permanently
F	Override "B"

One of the three Universal Commands may also be used. They are "Group Execute Trigger", "Device Clear", and "Go To Local".

2.4.1 Group Execute Trigger - The 10A must be addressed to "listen" in order to respond to the trigger message. The message causes the 10A to acquire and store panel meter data.

2.4.2 Device Clear - The 10A will respond to Device Clear by going to local and assuming an idle state.

2.4.3 Go To Local - When the Go To Local message is received, the 10A will return to local front panel control.

2.4.4 If the 10A is addressed to "talk", the data is sent out in the following format:

Range Code, Front Panel Display (floating point number), Range Condition (1 = underrange, 2 = overrange, 3 = range OK), CR/LF

Following are examples using the HP 9815 calculator as the controller.

Example 1: The user intends to select Voltage Mode, 30 mV range, hold the encode until the time to trigger it, and then obtain the meter data. Assume the rear panel address switch is set like this: Talk Only = 0, Listen Only = 0, Address = 10010 = 18 (Decimal).

The program may be like this:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
```

(Now the 10A is addressed to "listen".)

```
R
4
```

(30 mV range is selected.)

```
H
```

(Encode Hold)

```
T
```

(Trigger)

Responding to the trigger message, the 10A acquires and stores panel meter data. To obtain the data, the user may program as follows:

```
CALL α                  (go out of command mode)
CLEAR
1
ENTER ↑
18
ENTER ↑
CALL α
5
H
```

Now the controller acquires the data. The data string may be like this:

```
4                       (30 mV range)
12.3 -03                (E-03 = mV)
3                       (Range selected OK)
```

Example 1A: Using the HP 9825A with Gen I/O and extended I/O (ROM 98126A or 98213A)

```
10A Remote Enable                          rem718

30 mV range selected, Encode Hold,         wrt718,"R4HT"
Trigger

Data acquired by controller, stored        red718,A,B,C
in Registers A, B, and C

Displayed results                          dspA
                                            4.000e 00

                                           dspB
                                            12.3e-03

                                           dspC
                                            3.000e 00
```

Example 1B: Using the HP 9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
30 mV range, Encode Hold, Trigger	wrt718,"R4HT"
String allocated	dimA$[14]
Data acquired by controller	red718,A$
Displayed results	dspA$ 4,12.3e-03,3

Example 2: The user intends to select dB Mode, Auto Range, hold encode permanently, trigger the instrument, read the data, trigger it again later on, read the data, and then release Encode Hold.

The user may program as follows:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
(Now the 10A is addressed to "listen".)
D
(10A in dB mode)
A
(10A in Auto Range)
B
(Encoding is held permanently.)
T
(Trigger)
```

By using the program in Example 1, the controller may acquire the following data string:

4	(30 mV)
-23.41 00	(dB mode)
3	(Range condition is OK)

If the user wants to trigger the instrument again, the following program may be used.

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
```

(The 10A is addressed to "listen" again.)

```
T
```

(Trigger)

```
F
```

(Permanent Encode Hold released)

If the user programs the 10A to be "talker" again, he obtains the second data string.

Example 2A: Using the HP 9825A with Gen I/O and extended I/O (ROM 98126A or 98213A):

```
10A Remote Enable                          rem718

Auto Range Selected, Hold Encode,          wrt718,"QDABT"
Trigger. Alpha character inserted
string to slow 9825A.
10A
280
```

Data acquired by controller, stored in Registers A, B, and C	red718,A,B,C
Displayed results	dspA 4.000e 00 dspB -2.341e 1 dspC 3.000e 00
Instrument retriggered, Encode Hold released	wrt718,"TF"
Read data	red718,A,B,C
Displayed results	dspA -2.341e1

Example 2B: Using the HP9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
Auto Range selected, Hold Encode, Trigger	wrt718,"QABT"
String allocated	dimA$[14]
Data acquired by controller	red718,A$
Results displayed	dspA$ 4,-2.341e1,3
Instrument retriggered, Encode Hold released	wrt718,"TF"

10A
280

Data acquired by controller	red718,A$
Displayed result	dspA$
	4,-2.34le1,3

2.5 OPTION -05

Model 10A-05 is designed to be compatible with the 93AD RMS Voltmeter. It provides the user with the capability to select either Voltage Mode (by sending command "V") or dB Mode (by sending command "D"), to hold meter encoding (by sending command "H"), or trigger it (by sending command "T"), to select a specified range (by sending command "R01" - "R12") or Auto Range (by sending command "A"), Fast Response (by sending command "S1") or Slow Response (by sending command "S0"), 20 MHz BW (by sending command "M1") or 0.1 MHz BW (by sending command "M0").

Normally the Encode Hold message will be reset automatically after meter data has been sent. If such a version is not desirable, the user should send command "B" so that Encode Hold is permanently true. To release, command "F" should be used.

Refer to Table 6 for a summary.

TABLE 6

V	mV Mode
T	Trigger
H	Encode Hold
D	dB Mode
A	Auto Range
R	Range Selection (1 - 12)
B	Hold Encode Permanently
F	Override "B"
S	(S1 - fast response; S0 - slow response)
M	(M1 - 20 MHz BW; M0 - 0.1 MHz BW)

One of three Universal Commands may also be used. They are "Group Execute Trigger", "Device Clear", and "Go To Local".

2.5.1 Group Execute Trigger - The 10A must be addressed to "listen" in order to respond to the trigger message. The message causes the 10A to acquire and store panel meter data.

2.5.2 Device Clear - The 10A will respond to Device Clear by going to local and assuming an idle state.

2.5.3 Go To Local - When the Go To Local message is received, the 10A will return to local front panel control.

2.5.4 If addressed to "talk", the data is sent in the following format:

Range Code, Front Panel Display (floating point number), Range Condition (1 = underrange, 2 = overrange, 3 = range OK), CR/LF

Following are two examples using the HP 9815 calculator as the controller.

Example 1: The user intends to select Voltage Mode, 30 mV range, fast response, 20 MHz BW, hold the encode until the time to trigger it, and obtain the meter data.

Assume the rear panel address switch is set like this: Talk Only = 0, Listen Only = 0, Address = 10010 = 18.

The program may be like this:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
```

One of living O'Connor I Cannon Jr my ride , ... Chase.

Prospect", "Spencer Zander", and "Can To Local".

3.3.1 Optional Parameter Prompt — The log user's preferences to ' ' only in order to respond to the trigger reasons. The message replaces the bus to explore and above panel under data.

3.3.2 Develop [ ] — The Jr will respond to ' ' Glenn I ' ' '

```
RUN
(Now the 10A is addressed to "listen".)
R
4
(30 mV Range is selected.)
S
1
(Fast Response)
M
1
(20 MHz BW)
```

Example 1A: Using the HP 9825A with Gen I/O and extended I/O (ROM 98126A or 98213A)

10A Remote Enable	rem718
30 mV range selected; fast response, 20 MHz bandwidth, Encode Hold, Trigger	wrt718,"R4S1M1HT"
Data acquired by controller, stored in Registers A, B, and C	red718,A,B,C
Displayed results	dspA 4.000e 00 dspB 1.23e-03 dspC 3.000e 00

Example 1B: Using the HP9825A as configured in Example 1A with the addition of string ROM 98210A:

```
10A
280
```

10A Remote Enable	rem718
30 mV range selected, fast response, 20 MHz bandwidth, Encode Hold, Trigger	wrt718,"R4S1M1HT"
String allocated	dimA$[14]
Data acquired by controller	red718,A$
Displayed results	dspA$ 4,1.23e-03,3

Example 2: The user intends to select dB Mode, Auto Range, hold encode permanently, trigger the instrument, read the data, trigger it again later on, read the data, and then release Encode Hold.

The user may program like this:

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
(Now the 10A is addressed to "listen".)
D
(10A in dB Mode)
A
(10A in Auto Range)
B
(Encoding is held permanently.)
T
(Trigger)
```

By using the program in Example 1, the controller may acquire the following data string:

```
4                          (30 mV range)
-34.56      00             (dB Mode)
3                          (Range condition is OK)
```

If the user wants to trigger the instrument again, the following program may be used.

```
1
ENTER ↑
18
ENTER ↑
CALL α
5
CALL α
RUN
```

(The 10A is addressed to "listen" again.)

```
T
```

(Trigger)

```
F
```

(Permanent Encode Hold is released.)

If the user programs the 10A to be "talker" again, he obtains the second data string.

Example 2A: Using the HP 9825A with Gen I/O and extended I/O (ROM 98126A or 98213A):

```
10A Remote Enable                          rem718

Auto Range selected, Hold Encode,          wrt718,"DABT"
Trigger.  Alpha character inserted
before command string to slow 9825A.

10A
280
```

Data acquired by controller, stored in Registers A, B, and C	red718,A,B,C
Displayed results	dspA 4.000e 00 dspB -3.456e01 dspC 3.000e 00
Instrument retriggered, Encode Hold released	wrt718,"TF"
Read data	red718,A$
Displayed results	dspA 4.000e 00 dspB -3.456e01 dspC 3.000e 00

Example 2B: Using the HP 9825A as configured in Example 1A with the addition of string ROM 98210A:

10A Remote Enable	rem718
Auto Range selected, Hold Encode, Trigger	wrt718,"DABT"
String allocated	dimA$[14]

Data acquired by controller	red718,A$
Results displayed	dspA$ 4,-3.456e01,3
Instrument retriggered, Encode Hold released	wrt718,"TF"
Data acquired by controller	red718,A$
Displayed result	dspA$ 4,-3.456e01,3

CHAPTER III

THEORY OF OPERATION

3.1 GENERAL

3.1.1 The 10A is a microprocessor driven data interface which converts IEEE-488 Bus compatible signals into control codes which operate the internal control bus of Boonton's Model 42BD, 62AD, 72BD, 92BD, or 93AD. In addition, it converts the instrument's data into IEEE-488 compatible signals for use on the Bus.

3.1.2 All data transfers are handled by source and acceptor handshake protocol as defined by IEEE-488-1975.

3.2 SIMPLIFIED THEORY AND BLOCK DIAGRAM

3.2.1 GENERAL. For purposes of this discussion, the logic circuits of the Model 10A may be grouped by function as follows: CPU and memory circuits, instrument interface circuits, and controller interface circuits.

Refer to Figure 3-1 for the simplified block diagram.

3.2.2 CPU AND MEMORY CIRCUITS. The CPU clocks are generated by the clock and timing circuits. Timing is controlled by a tank circuit and a feedback capacitor. The clock frequency is about 1.1 MHz.

Data transfers are controlled by a Z-80 microprocessor in conjunction with 1024 bytes of Read-Only memory and 256 bytes of Random Access memory.

Refer to Figure 3-2 for simplified circuits.

3.2.3 INSTRUMENT INTERFACE CIRCUITS AND CONTROLLER INTERFACE CIRCUITS. All input and output data are controlled by two Intel 8255 registers. The Z-80 microprocessor selects either register and the direction of data flow.

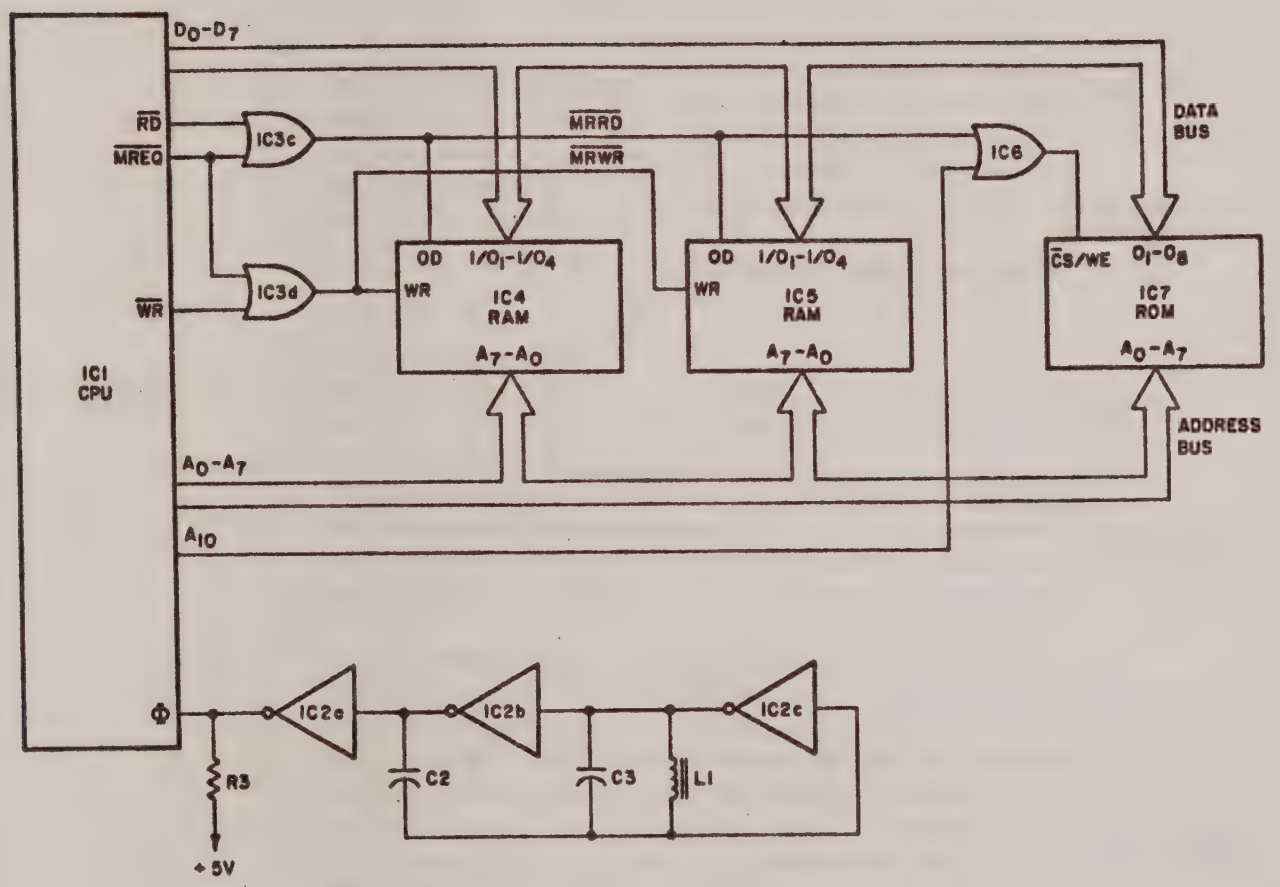
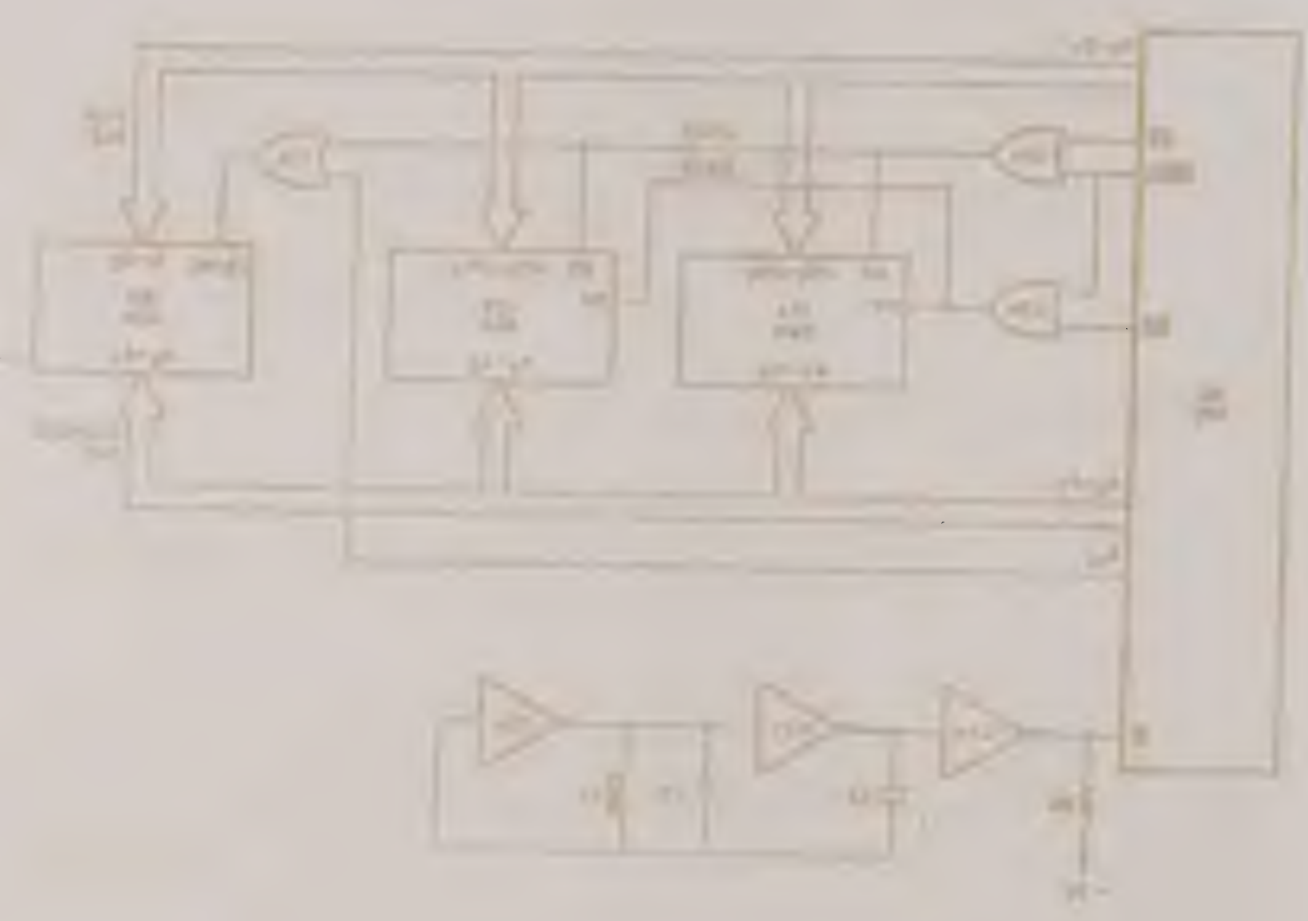


Figure 3-1. Simplified CPU and Memory Circuits



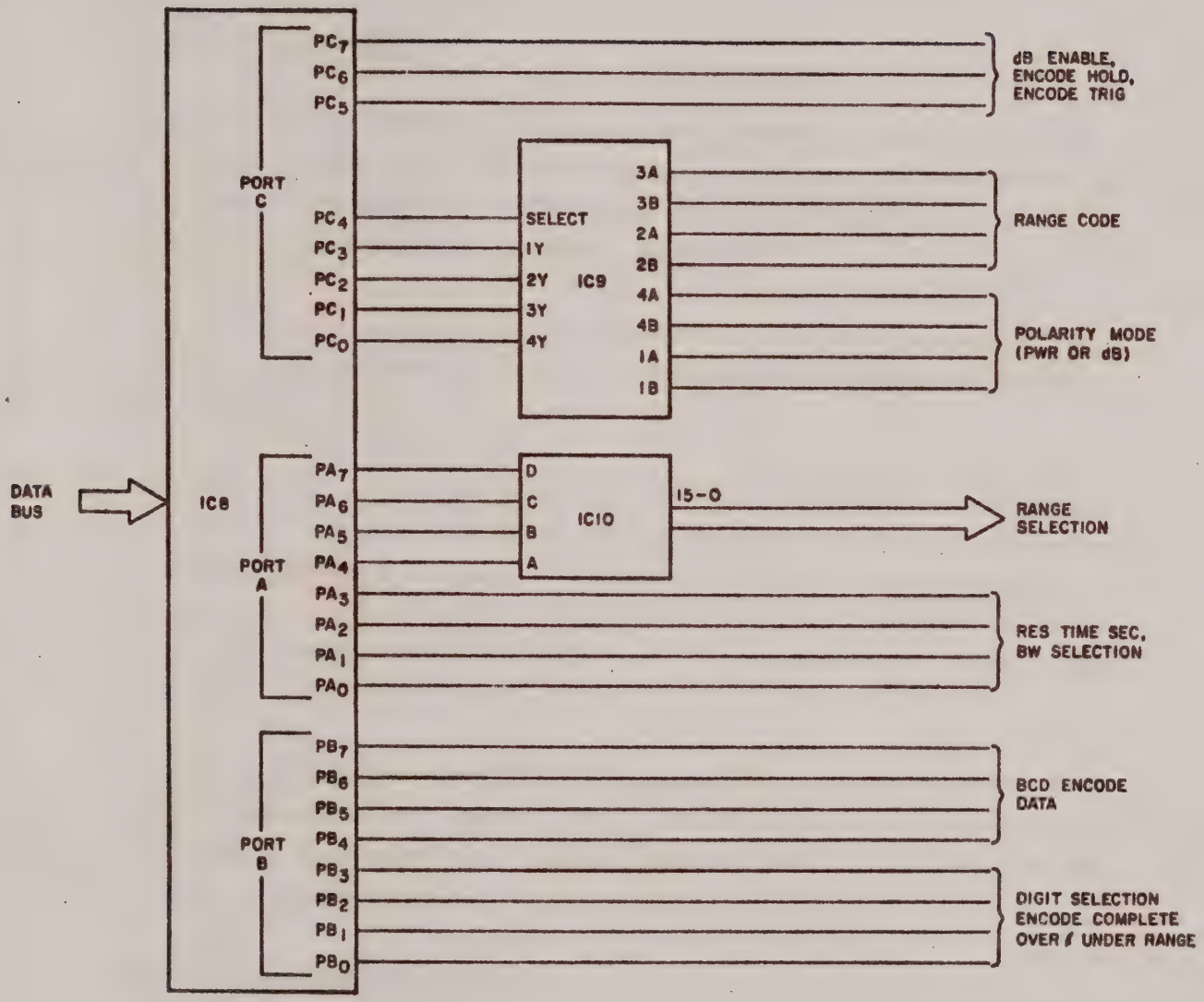
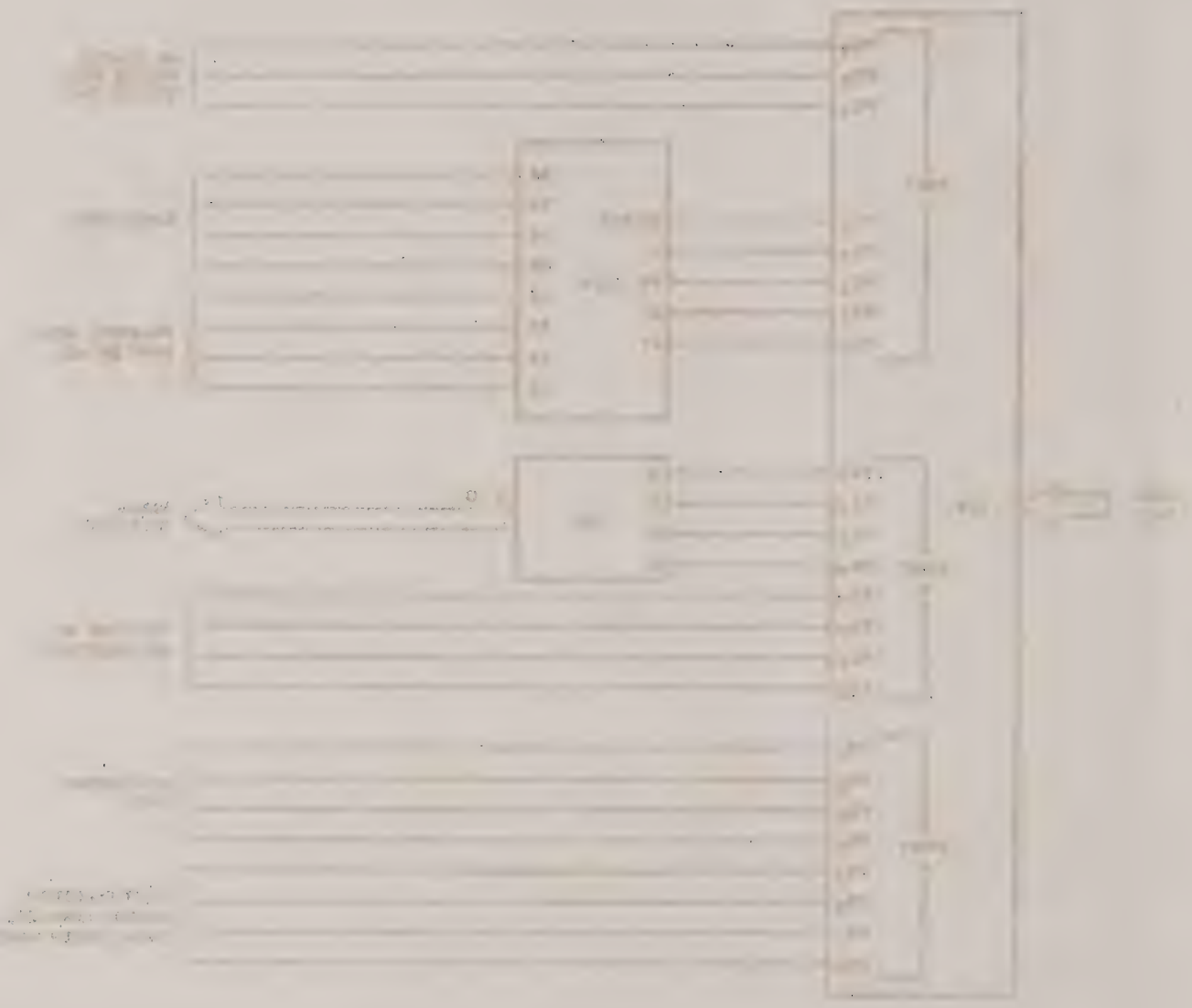


Figure 3-2. Simplified Instrument Interface Circuits



Refer to Figure 3-3 for simplified circuits.

3.3 DETAILED THEORY OF OPERATION. Refer to Schematic 830927, Sheets 1 through 4.

3.3.1 CPU AND MEMORY CIRCUITS

a) Capacitor C3 and inductor L1 form the tank circuit for oscillation. This signal is inverted by IC2a to provide a symmetrical clock waveform required by the microprocessor. I/O Read, I/O Write, Memory Read and Memory Write signals are by "OR gates" IC3b, IC3a, IC3c, and IC3d respectively.

b) All of the data manipulation and IEEE-488 Bus management are controlled by the Z-80 CPU IC1 in conjunction with a 1024 byte micro-program stored in Read-Only memory chip IC7.

c) Power on reset is provided by C1, R1, and CR1. When power is applied, C1 charges slowly through R1. This holds the CPU reset line "low" until the capacitor is fully charged. A software loop holds the processor in an idle state until a handshake sequence is initiated via the IEEE-488 Bus. As a part of power-on initiation, the random access memory (IC4 and IC5) is cleared and proper memory pointers are established.

d) Program flow and data transfers are controlled by micro-code stored in IC7. Refer to Schematic 830927, Sheet 1 of 4. Random access memory is used for temporary storage of instrument panel settings and DPM data. It is also used for control flags and commands storage.

3.3.2 INSTRUMENT INTERFACE CIRCUITS

a) All instruments' control settings, status, and panel meter data are handled by Register IC8.

The upper part of port A of IC8 (pin 37 - Pin 40) is the range of data to be sent to the instruments. Demultiplexer IC10 decodes the range data. The lower part of port A (Pin 4 - Pin 1) is used for controlling of "Fast - Slow Response" and "20 MHz - 0.1 MHz BW Selection" (Option -05 only).

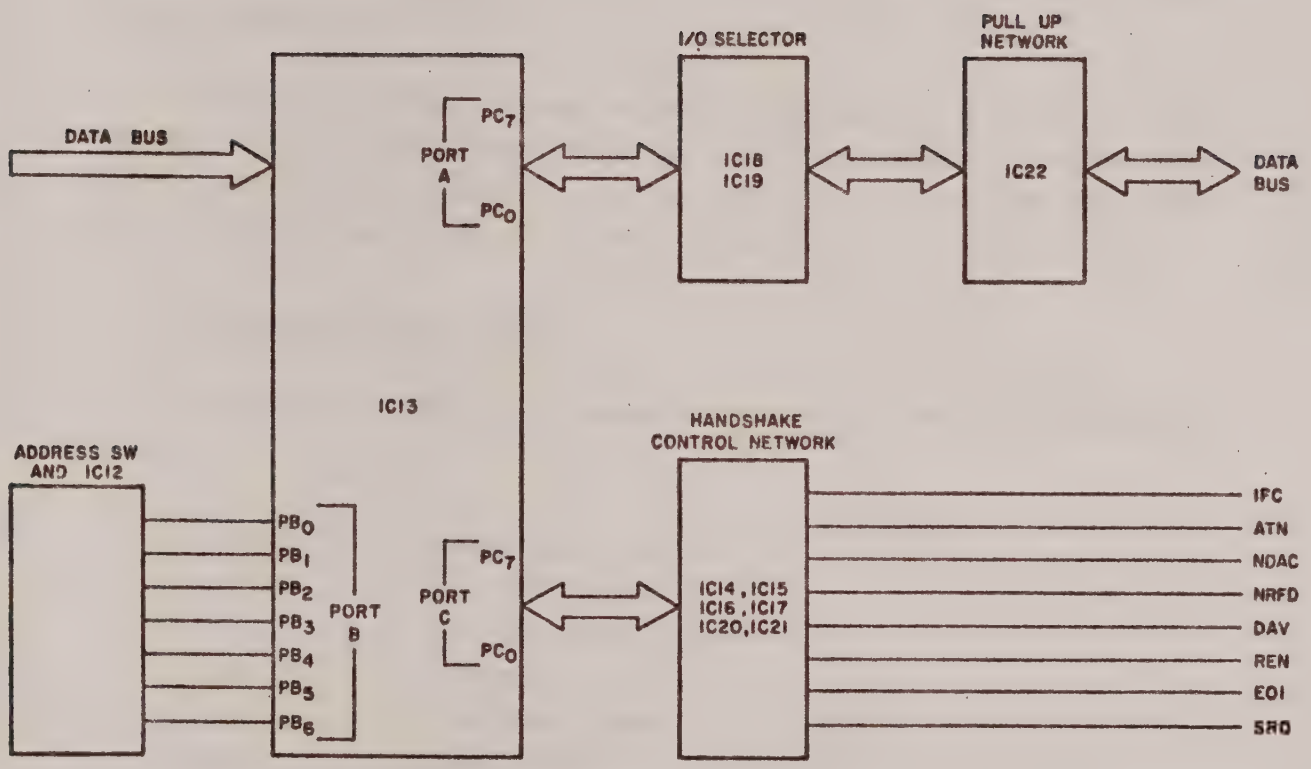
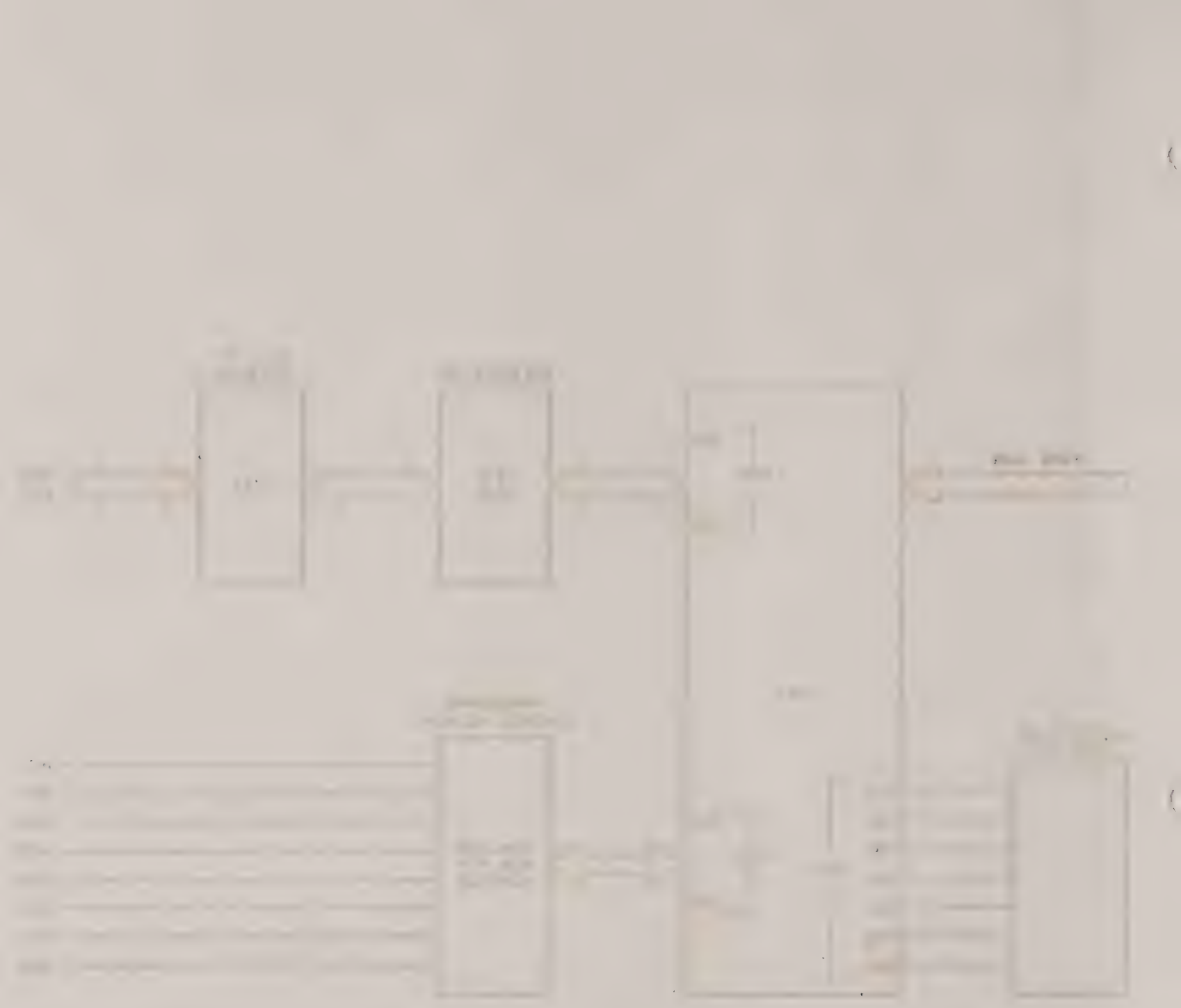


Figure 3-3. Simplified Controller Interface Circuits



The upper part of port B (Pin 25 - Pin 22) is BCD encoded panel meter data. The lower part of port B (Pin 21 - Pin 18) is used for Encode Complete (Pin 20), Over Range (Pin 19) and Under Range (Pin 18).

The upper part of port C (Pin 10 - Pin 13) is used for dB Enable (Pin 10), Encode Hold (Pin 11) and Encode Trigger (Pin 12). Pin 13 is control signal for Data Selector IC9. The lower part of port C (Pin 17 - Pin 14) is range code or "dB Mode - Power Mode".

b) All data transfers are parallel-to-parallel mode. Port selection and I/O controlling are done by software stored in Read-Only Memory. Address bit A0 and A1 (Pins 9 and 8) are used for port selection. Read, Write, and Chip Enable are controlled by pins 5, 36, and 6 respectively.

3.3.3 CONTROLLER INTERFACE CIRCUITS

a) Following is the list of terminology used in the Controller Interface Circuits:

DAV	DATA VALID
NRFD	NOT READY FOR DATA
NDAC	NOT DATA ACCEPTED
ATN	ATTENTION
IFC	INTERFACE CLEAR
REN	REMOTE ENABLE
SRQ	SERVICE REQUEST
EOI	END OR IDENTIFY

b) All data transfers are handled by source and acceptor handshake protocol as defined by IEEE-488-1975.

Port A of register IC13 is used for data in/out.

Port B of register IC3 is used for mode selection and address setting.

Port C of register IC13 is used for handshake controlling. When power is turned on, the software makes Talk = False (Pin 10 of IC16b = 0), Listen = False (Pin 4 of IC16c = 0). When the controller sends commands, ATN = True, Flip-Flop IC17b becomes reset. Pin 4 of IC16c is "High", IC20c and IC20d are released for NRFD and NDAC signals.

If the 10A is addressed as a talker, a clock pulse is generated on Pin 13 of IC13. Pin 10 of IC16b is "High", IC20b is released for DAV signal.

If ATN = True or IFC = True during talking, Pin 13 of IC16a is "Low". Flip-Flop IC17a is reset. Pin 10 of IC16b is "Low", Talk = False.

c) All data transfers are parallel-to-parallel mode. Port selection and I/O controlling are done by software stored in Read-Only Memory.

Address bits A0 and A1 (Pin 9 and Pin 8) are used for port selection. Read, Write, and Chip Enable are controlled by pins 5, 36, and 6 respectively.

TABLE OF REPLACEABLE PARTS

Reference		Description	BEC Part No.
C1	Capacitor, Tant.	10 µF 20% 25 V	283293
C2	Capacitor, Cer.	100 pF 5% 300 V	224282
C3	Capacitor, Cer.	470 pF 1% 300 V	224255
C4 through C8	Capacitor, Tant.	10 µF 20% 25 V	283293
C9	Capacitor, Elec.	2000 µF -10/+100% 15 V	283325
C10	Capacitor, Elec.	2000 µF -10/+100% 15 V	283325
C11	Capacitor, Elec.	2000 µF -10/+100% 15 V	283325
CR1	Diode, Sig.	1N914	530058
CR2	Diode, High Power	VSK-140	532022
CR3	Diode, High Power	VSK-140	532022
CR4	Diode, Sig.	1N4001	530151
CR5	Diode, Sig.	1N4001	530151
CR6	Diode, Zener	1N5235B (6.8 V)	530089
CR7	Diode, Zener	1N5231B (5.1 V)	530169
F1	Fuse	1 A (For 110 V Operation)	545510
F1	Fuse, Slo-Blo	1/2 A (For 230 V Operation)	545504
IC1	Integrated Circuit	Z80-CPU-PS (CPU)	534159
IC2	Integrated Circuit	SN7404N (Hex Inverter)	534042
IC3	Integrated Circuit	SN74LS32N (OR Gate)	534168
IC4	Integrated Circuit	P2111A-4 (RAM)	534162
IC5	Integrated Circuit	P2111A-4 (RAM)	534162
IC6	Integrated Circuit	SN74LS32N (OR Gate)	534168
IC7	Integrated Circuit	C2708 (-01 Option Only) PROM	534174
IC7	Integrated Circuit	C2708 (-02 Option Only) PROM	534175
IC7	Integrated Circuit	C2708 (-03 Option Only) PROM	534176
IC7	Integrated Circuit	C2708 (-04 Option Only) PROM	534177
IC7	Integrated Circuit	C2708 (-05 Option Only) PROM	534178
IC7	Integrated Circuit	C2708 (-06 Option Only) PROM	534180
IC8	Integrated Circuit	P8255 (Programmable Interface)	534171
IC9	Integrated Circuit	SN74LS157N (Data Selector)	534170
IC10	Integrated Circuit	SN74159N (Decoder)	534204
IC11	Integrated Circuit	SN7405N (Hex Inverter)	534040
IC12	Resistor Network	3 kΩ	345017
IC13	Integrated Circuit	P8255 (Programmable Interface)	534171
IC14	Integrated Circuit	SN74LS00N (NAND Gate)	534167
IC15	Integrated Circuit	SN74LS04N (Hex Inverter)	534155
IC16	Integrated Circuit	SN7402N (NOR Gate)	534027
IC17	Integrated Circuit	SN74LS74N (Flip-Flop)	534157
IC18	Integrated Circuit	8T26B (Driver/Receiver)	534097
IC19	Integrated Circuit	8T26B (Driver/Receiver)	534097
IC20	Integrated Circuit	SN7438N (NAND Buffer)	534108
IC21	Resistor Network	3 kΩ/6.2 kΩ	345016
IC22	Resistor Network	3 kΩ/6.2 kΩ	345016

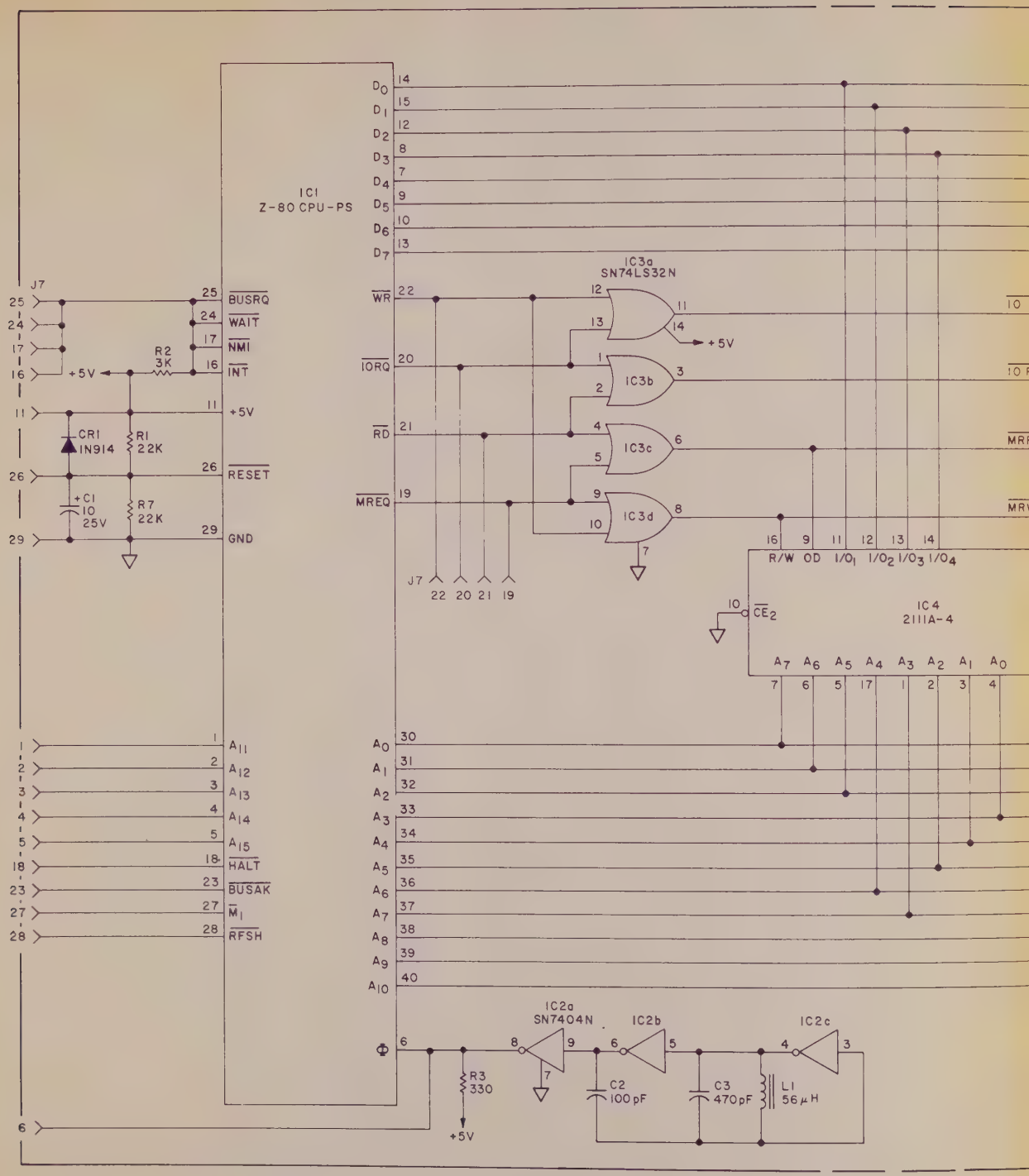
10A

Reference		Description	BEC Part No.
IC23	Integrated Circuit	Voltage Regulator µA78MGU1C	535042
J1	Not Used		
J2	Connector	24 Pin AMP 552230-1	479350
J3	Not Used		
J4	Connector Housing	3 Pin Molex 03-06-1031	479298
J5	Connector Housing	4 Pin Molex 03-06-1043	479340
K1	Relay	Allied Control E22N	471039
L1	Choke, RF	56 µH	400321
P1	Not Used		
P2	Not Used		
P3	Connector	Line Cord	477281
R1	Resistor, Comp.	22 kΩ 5%	343433
R2	Resistor, Comp.	3 kΩ 5%	343346
R3	Resistor, Comp.	330 Ω 5%	343250
R4	Resistor, Comp.	4.7 Ω 5% 2 W	304998
R5	Resistor, Comp.	160 Ω 5% 2 W	304068
R6	Resistor, Comp.	240 Ω 5%	344237
R7	Resistor, Comp.	22 kΩ 5%	343433
R8	Resistor, Comp.	4.7 kΩ 5%	343365
R9	Resistor, Comp.	4.7 kΩ 5%	343365
S1	Switch, Slide	CTS-206-7	475215
T1	Transformer	Signal DPC-20-500	446085

MISCELLANEOUS PARTS

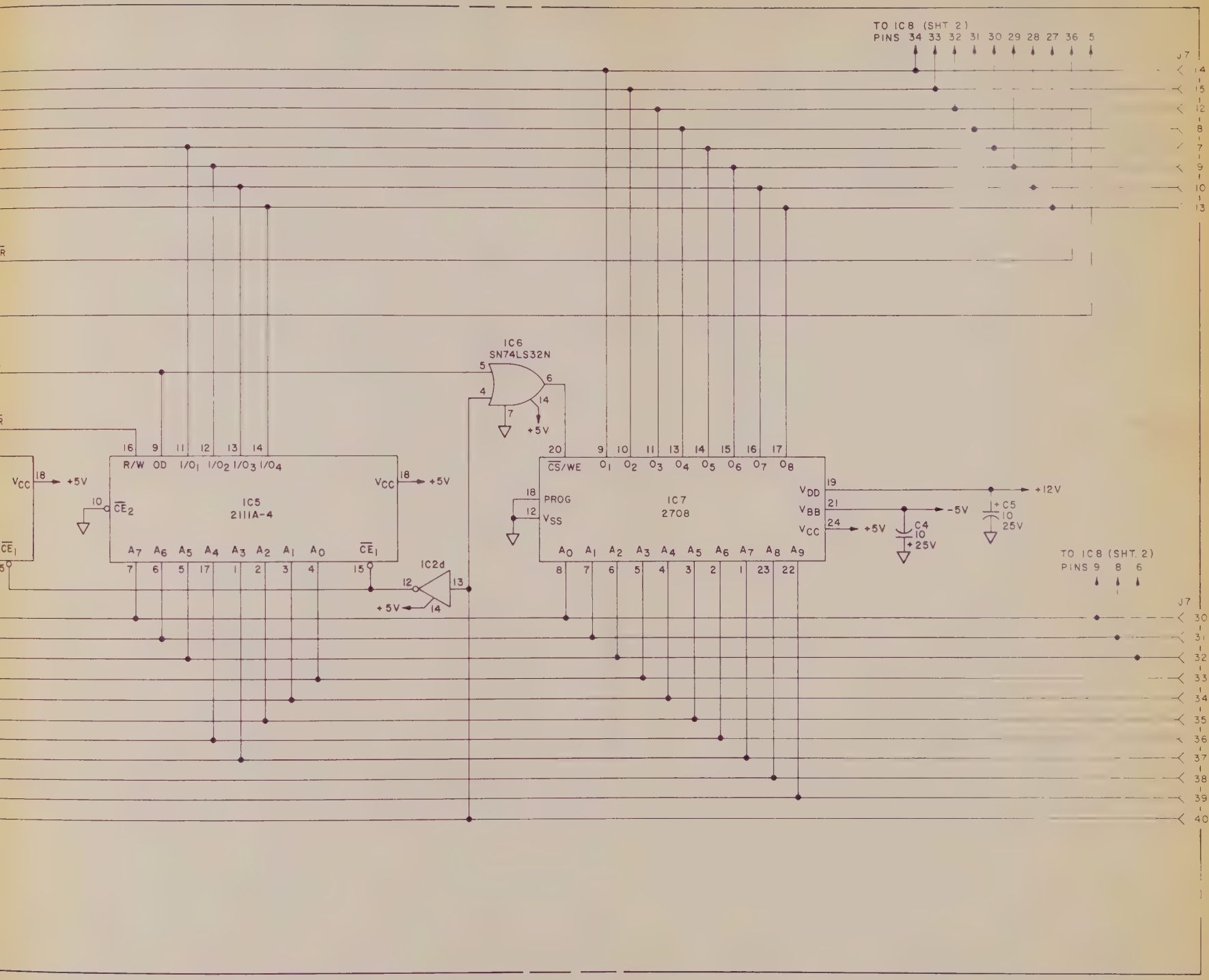
	Connector	22 Pin (Cable Adapter)	479254
	Line Cord		568106
	Cable	Interconnecting (1M LG) H.P.	571133
	Cable	Ribbon (1M LG) B.E.C.	010007
	Mounting Kit	Metric	483212

IEEE BUS INTERFACE P.C. BOARD



NOTES:

1. CAPACITANCE VALUES IN μF UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS.
3. LAST NUMBERS USED:
   C5 IC7 R7



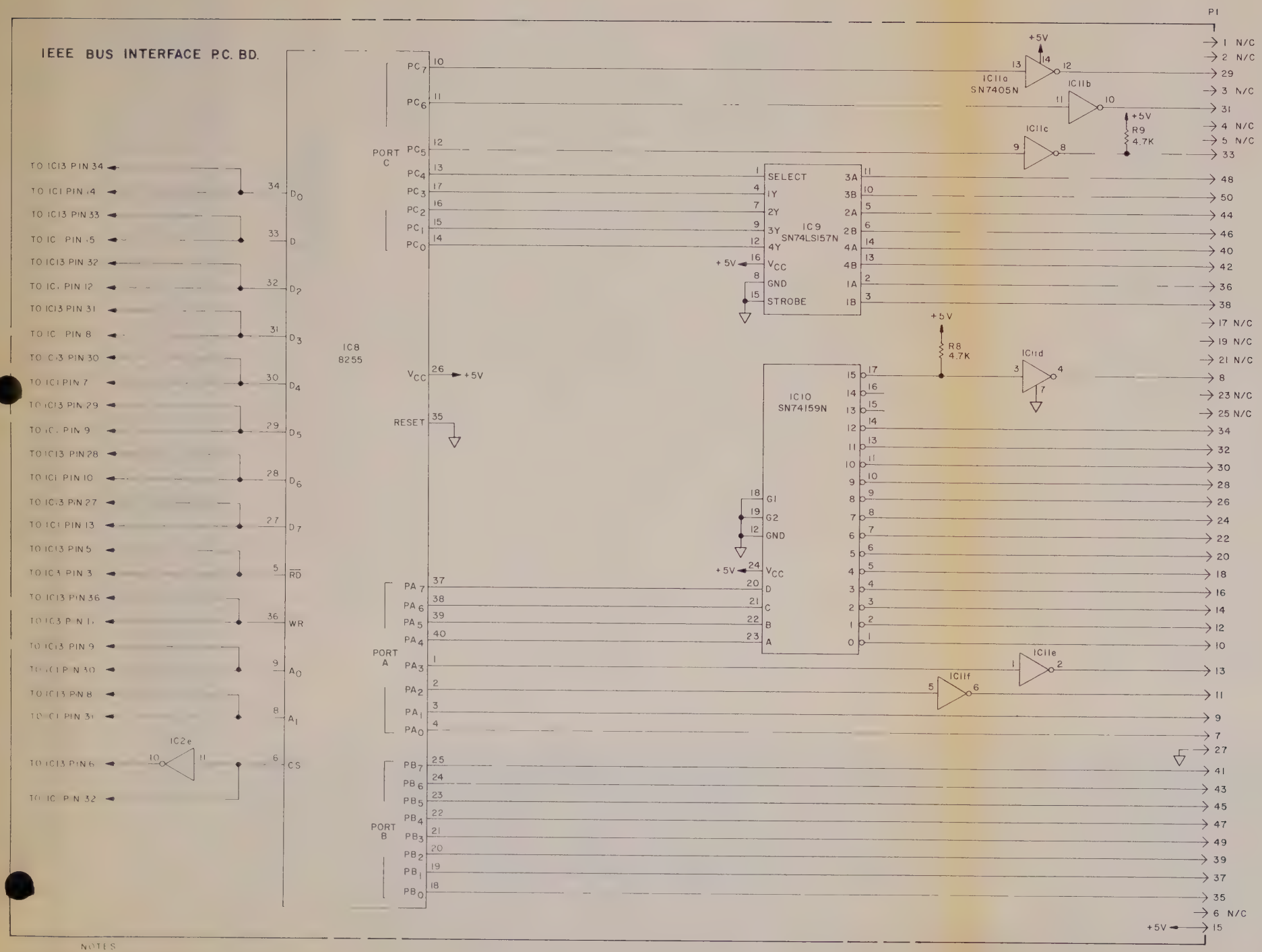
BOONTON ELECTRONICS CORPORATION

MODEL 10A-01,-02,-03,-04,-05
Schematic, IEEE Bus Interface
P.C. Bd.
J830987B Sht. 1 of 4

P1
CONNECTS TO P1
ON INTERFACE P.C. BD. (10A-01)
566785
SCHEMATIC NO. 831039

AND

CONNECTS TO P1
ON INTERFACE P.C. BD. (10A-05)
566790
SCHEMATIC NO. 831040

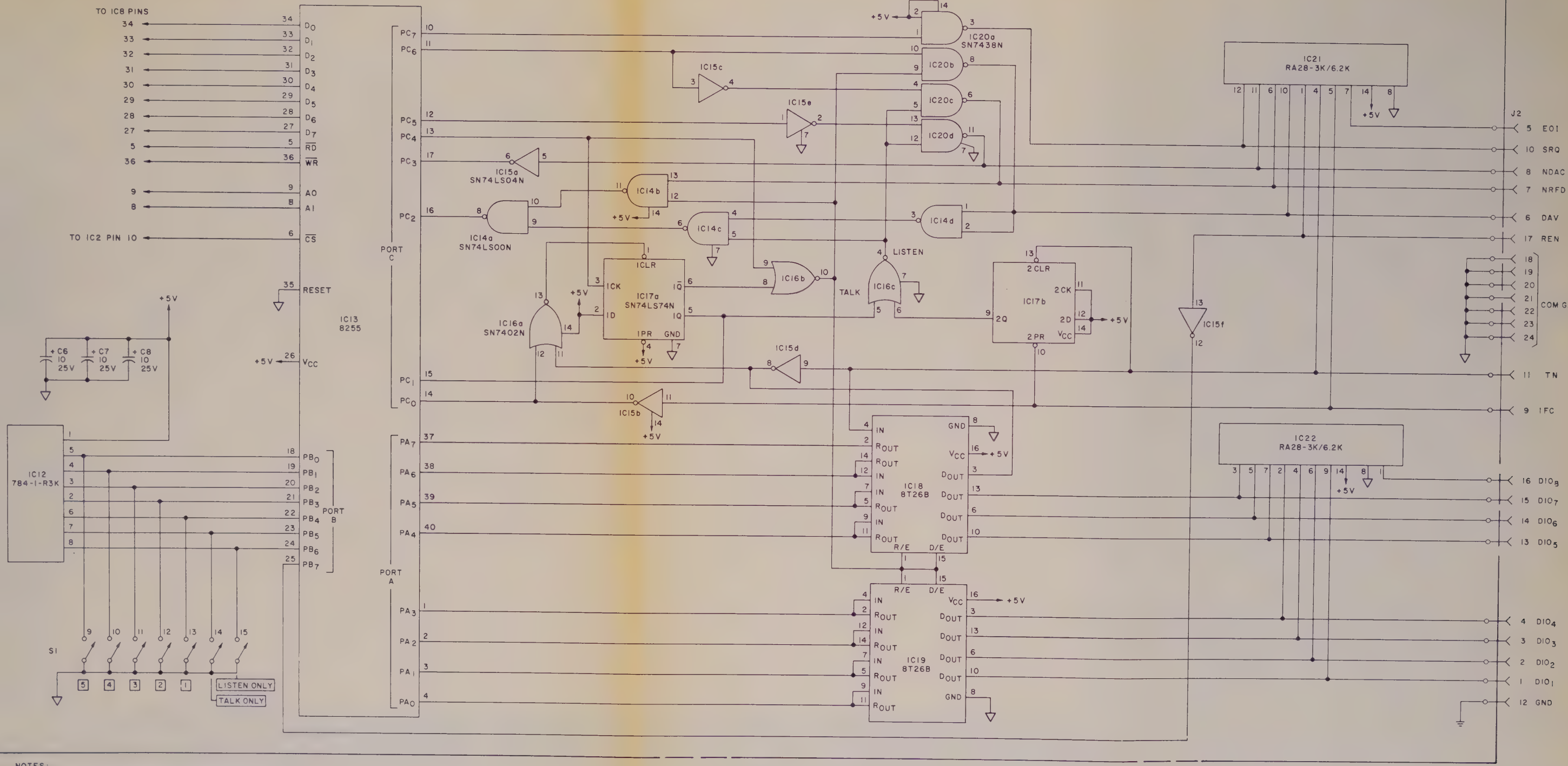


NOTES
1. LAST NUMBERS USED
C1.

BOONTON ELECTRONICS CORPORATION

MODEL 10A-01,-02,-03,-04,-05
Schematic, IEEE Bus Interface
P.C. Bd.
E830987B Sht. 2 of 4

IEEE BUS INTERFACE P.C. BOARD



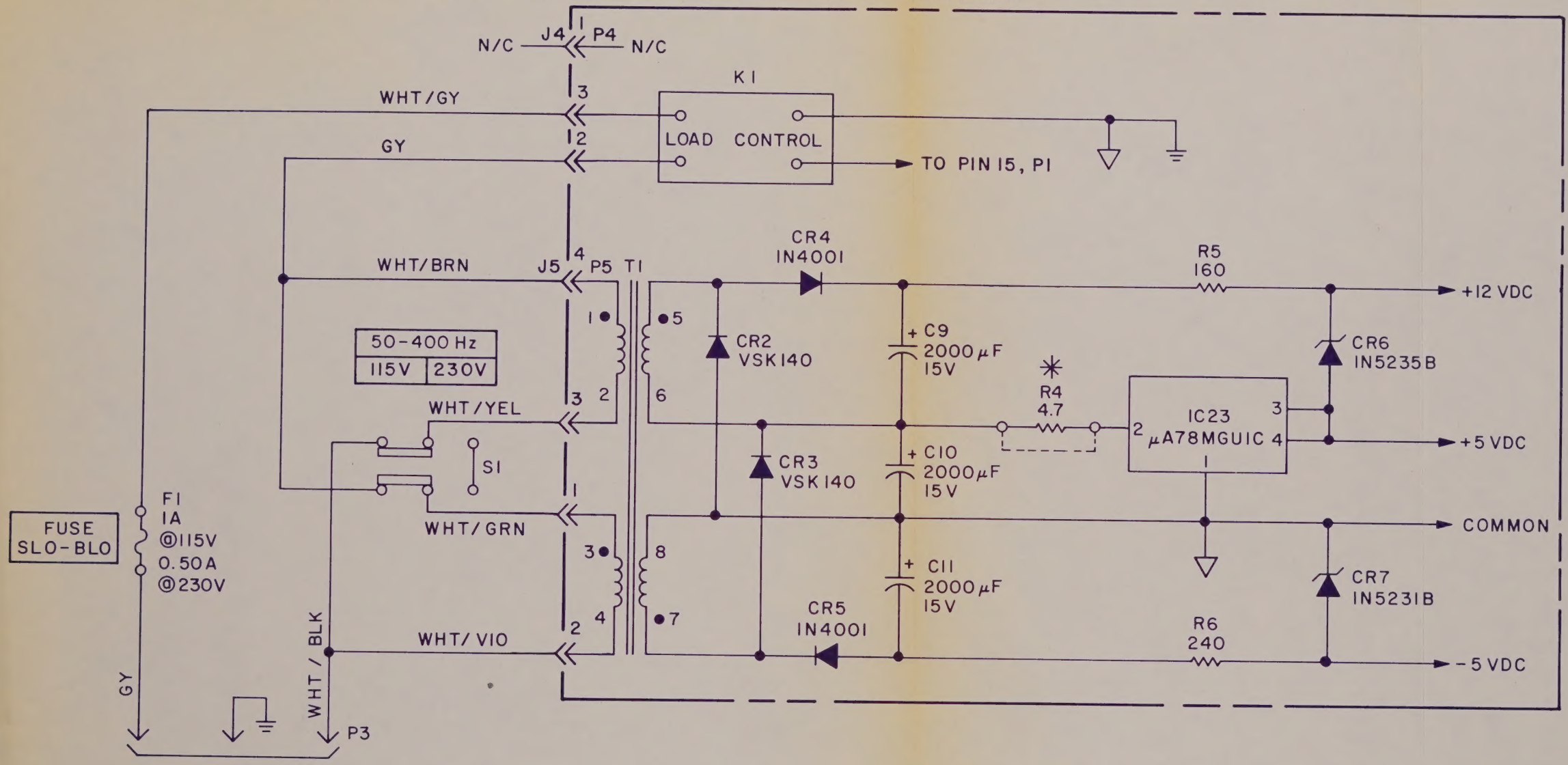
NOTES:

1. CAPACITANCE VALUES IN μF, UNLESS OTHERWISE SPECIFIED
2. ☐ EXTERNAL MARKINGS.
3. LAST NUMBERS USED:
   C8 IC22

BOONTON ELECTRONICS CORPORATION

MODEL 10A-01,-02,-03,-04,-05
Schematic, IEEE Bus Interface
P.C. Bd.
J830987A Sht. 3 of 4

IEEE BUS INTERFACE P.C. BOARD - POWER SUPPLY SECTION



NOTES:

1. RESISTANCE VALUES IN OHMS.
2. ✳ REPLACE THIS RESISTOR WITH JUMPER FOR 100V OPERATION.
3. ▭ EXTERNAL MARKINGS.
4. LAST NUMBERS USED:
   CR7 R6 C11

BOONTON ELECTRONICS CORPORATION

MODEL 10A-01,-02,-03,-04,-05
Schematic, IEEE Bus Interface
P.C. Bd.
C830987C Sht. 4 of 4

MP MASTER
MA24265